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ABSTRACT

Designed to acquaint students in grades 4-9 with aquatic plants and animals, this guide provides materials which can be used in preparation for field trips or laboratory work, for individual projects, as supplemental activities for a unit, or for learning center projects. Teacher background notes and an answer key for the student activites are followed by: (1) a 2-page bibliography of titles for student and teacher reference published between 1943 and 1978; (2) 15 pages of definitions covering terminology used in the study of aquatic plants and animals; (3) activities introducing the plants, animals, and the food pyramid found in ponds and lakes; (4) activity sheets for field trip observations; (5) field trip preparations and activities; (6) procedures for setting up an aquatic life laboratory and for studying items collected on field trips; (7) an aquatic life laboratory record sheet and directions for making aquatic insect aquariums; (8) instructions for raising dragon fly nymphs and for collecting and maintaining diving beetles, water scavenger beetles, water scorpions, and water boatman beetles in the aquariums; and (9) activities for observing hydra and planaria. A word puzzle on aquatic life terms and illustrations of several aquatic insects and of an aquatic insect aquarium are included. This document is part of a collection of materials from the Iowa Area Education Agency 7 Teacher Center project. (JW)

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AQUATIC HABITATS

level 4-9

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Teacher Center Director - Diane Gibson, Ed. D.

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LIST OF ACTIVITIES

Teacher Notes and Answer Keys
Definitions of Aquatic Terms
Food Pyramid
    Food Chain - optional
    Food Web - optional

Algae
Habitats of Pond and Lake Plants (does not include Algae)
    Plants that Grow on Shore
    Emergent Plant Zone
    Floating Water Plants
    Submerged Water Plants

Some Aquatic Animals
    Protozoa
    Colenterates - Hydra
    Platyhelmenthies Planaria
    Rotifers
    Tardigrada (Water bears)
    Annelida (Segmented worms)
    Phylum Arthropoda
        Class Crustacean
            Water flea
            Cope pods
            Sideswimmers
            Crayfish

        Class Insects
            Collembola (spring tails)
            Dragon flies and Damsel flies
            Hemiptera (The true bugs)
                Water measure, Giant Water Bug,
                Water Strider, Water Boatman,
                Backswimmer
            Coleoptera (the Beetles)
                Crawling Water Beetles, Diving Beetle,
                Water Scavenger Beetle, Whirigig Beetle
            Mosquito

        Gastro pods (snails)
        Finger nail Clams
        Pond Activities - General observation of pond
        observing animals in a small area of a pond.
        Field trip to a pond, pool or stream.
        Laboratory Aquatic Life

Aquatic Insect Aquariums
General Directions for Making Insect Aquariums
Raising Dragon fly Nymphs
Diving Beetle Aquarium
Water Scavenger Beetle Aquarium
Water Scorpian Aquarium
Giant Waterbug Aquarium
Water boatman Aquarium

Observing Hydra
Observing Planaria
Aquatic Life Maze

Illustrations of Water Bugs
Illustrations of Water Beetles
Bibliography

TEACHERS NOTES:

The preceding was a list of activities included in this unit. Some of the common plants and animals that are often found by students have been marked with an asterisk. Several aquatic plants and animals have been included - you will not find all of these organisms on a single field trip or in one habitat. Therefore, you may wish to select some,but not all, of these activities for your class.

Activities for vertebrate animals were not included since students are usually familiar with them. You may wish to add them.

Some of the activities in this unit could be used for:

a. Preparation for field trips
b. Preparation for laboratory work
c. Individual projects
d. Supplement activities for a unit on plants, animals (arthropods, insects, etc).
e. Learning center projects.

Teachers of grades 4-6 may want to omit the study of microscopic plants and animals. The Outdoor Biology Instructional Strategies (OBIS), an NSF supported project, has a booklet called Pond Guide that you will find useful. This is inexpensive (less than $1.00) and was designed for 10-15 year olds. It contains illustrations and the characteristics of aquatic plants and animals that you can see without a microscope. This would also be a useful reference for students in grades 7-9. The books published by Golden Press are also good general references. The book Pond Life published by Golden Press is referred to in the answer key. The Area VII Media Center has some good books that can be used as references. See the bibliography.

Equipment Need for Field Trips

See the list for students in "Field Trip to a Pond, Pool or Stream". Several books and teachers manuals give instructions for making aquatic nets, planton net, etc. You may want to have your class make their own dip nets out of clothes hangers and old nylons.

Refer to OBIS materials "Equipment and Technique Card" from Trail Edition Pond Life by Golden Press pp. 28-29. You can also find this information in several other pond life references.

Preparation for Field Trips

- Always check out the pool, pond, etc. that you are going to use for a field trip. No Two Ponds (even if they are near each other) will be exactly alike. They also change during the season.

- Be sure to have at least 1 adult per 8 students.

- The Field Trip to a Pond, Pool or Stream Activity was written for a student that might want to do this as an individual project. This also contains the instructions you might want to give to your class. It contains detailed directions. The ESS Teachers Guide to Pond Life has some good field trip suggestions.

Lab on Aquatic Life

Equipment is listed on the activity sheet. HAVE SEVERAL BOOKS AVAILABLE FOR REFERENCES.

Macroscopic life - students can observe by putting them in a white enameled pan or white plastic containers. They might want to put some in aquariums. If they find something they have not studied, you may want to assign an activity sheet on that plant or animal.

Aquatic Insect Aquariums

Food references for students and teachers are: Beetles by Wilfred S. Bronson and Water Beetles by Dorothy Childes Hogner. (All of Hogner's books about animals are excellent). Bronson's book is available at the Area VII Media Center. It has directions for an aquatic insect aquarium that contains several kinds of insects. It could be used as a class project.

Resources used as references in this unit are:

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University of California
Berkely, California 94720

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Selsam, Millicent E. and Joyce Hunt, A First Look at Frogs, Toads, and Salamanders, New York: Walker and Company, 1976.

ANSWER KEYS

DEFINITIONS OF AQUATIC TERMS

1. Aquatic - growing or living in or upon water (the prefix aqua means water).
2. Habitat - the place where a plant naturally grows or lives. (the place where a plant or animal is usually found.)
3. Environment - the conditions surrounding a plant or animal.
4. Stream - a small river. Water that is flowing over the surface.
5. Pond - a quiet body of water so shallow that plants grow across it. Smaller than a lake.
6. Pool - a quiet body of water smaller than a pond. A puddle - some people call small ponds a pool.
7. Lake - larger than a pond. The only place plants grow is around the shore. The water is too deep for plants to grow all the way across.
8. Marsh - swamp. An area of wet, soft land.
9. Stagnant - no moving water. Stagnant water often has an odor.
10. Debris - broken pieces of twigs, leaves, rocks, etc.
11. Surface - outer part or top of the water in a pond, lake, etc.
12. Food Web - shows the relationships of plants and animals to each other and to their environment.
13. Plankton - microscopic plant and animal life that floats or drifts in water.
14. Phytopankton - microscopic plant life that floats or drifts in water.
15. Zoo plankton - microscopic animal life that floats or drifts in water.
16. Phylum - a broad division of the plant or animal kingdom.
17. Limnology - the study of fresh waters. (The study of the biology, chemical, geographical and physical features of ponds and lakes.)
18. Limnologist - a person who specializes in the science of limnology. A person who studies and the special features of inland waters. (Fresh water)

FOOD PYRAMID

1. Herbivore - eats grass, or plants
2. Carnivore - flesh eating - - - eats animals
3. Plankton - microscopic plants and animals that float in water
4. Phytoplankton - microscopic plants in plankton
5. Zooplankton - microscopic animals in plankton
6. Consumer - animal that uses or eats other animals and plants
7. Producer - provides other living things. eg. plants produce food for some animals
8. See P. 23 of Pond Life published by Golden Press
9. Phytoplanton
10. Zoo Planton
11. Produces oxygen and/or food for animals in the pond
12. Carnivores
13. a. smaller carnivores usually (they are meat eaters)
    b. because they are meat eaters and they are fewer in number, they depend on the plants and animals that are lower in the pyramid for food
14. Plants
15. Animals

Part B & C - Many science texts have examples of these

Oxygen - Carbon Dioxide Cycle

1. See A Golden Guide - Pond Life, pp. 12-13 for one example. Some encyclopedias and other references will also have this diagram.
2. Photosynthesis - the making of food (carbohydrates) in living plants from water and carbon dioxide, by the action of sunlight on the chlorophyll.
3. Respiration - process of inhaling and exhaling air.
4. a. oxygen
   b. carbon dioxide
   c. oxygen
   d. oxygen
   e. carbon dioxide

12

5. Plants produce oxygen for animals and animals give off carbon dioxide gas for the plants - oxygen and carbon dioxide are needed for survival.

6. Cycle - A series of events or changes that keep recurring.

7. It keeps recurring - plants produce oxygen for animals - animals give off carbon dioxide for plants.

*Algae

1. Algae - group of plants containing chlorophyll and having no true root, stem or leaf. Some are one celled, some are colonial, and others are many celled.

2. Usually ponds, pools, stagnant water, back water of streams, damp places, pond scum, etc. Can be found on the surface, bottom, on plants or animals, floating, etc.

3. Blue green, green, stoneworts, Euglenoids, Dioflagellates, Diatoms

Bluegreen Algae

4. Characteristics - no nuclei in the cells (nucleus not well defined)
   - scattered pigment
   - slimy coating
   - most kinds have cells that form filaments

5. A blue pigment is often present

6. Ponds that have much organic matter. Ponds that are polluted.

7. It gives the water a disagreeable odor.
8. It gives the water a disagreeable taste.
9. It can make the water poisonous to animals that drink it.

10. & 11. Drawings (see illustrations in various texts or books)

Green Algae

12. Characteristics:
    Cells have nuclei
    Chloroplasts -- pigments in distinctive bodies
    Nucleus is well defined
    Might be single celled or as filaments

13. See various reference for examples of the drawings

14. No question. Check and see if students drew a horizontal line under the green algae.

Diatoms

15. Characteristics:

    Enclosed in two shells that fit together like a shoe box
    Some cells have very fine lines
    Yellow-green algae

16. Diatoms are enclosed in two pill like shells. Desmids are not. Desmids have a clear connection in the middle of the cell . . . desmid cells appear to be divided in half.

17. - 20. No questions
    #18 check and see if diagrams are labeled - refer to various references for examples of the drawings

    #19 Drawings should be attached to the end of the assignment

Habitats of Pond and Lake Plants

Plants that Grow on the Shore

1. a. These plants have no flowers
      The stems are hollow and jointed
      They have scale like leaves
      The plant has a shaggy tail-like appearance
      Horse tails feel rough when you touch them

   b. Because they have a tail-like appearance

2. Sedges
      Plants that are grass-like
      They usually grow in tuffs or clumps
      The stems are 3 sided

Emergent Plant Zone - Cat tails

3. a. Roadside ditches have to have some standing water in them. (they are marsh-like).
   b. It is a tall plant with long, flat, reed like leaves. It has a brown fuzzy flower spike at the top.

Rushes

4. a. Spike - sharp pointed part or projection (in plants a spike is a long flower cluster with flowers attached directly to the stalk).
   b. The stems are hollow and pithy.

Water Plantain

5. Pointed oval leaves. Leaves are usually large, flowers are small --- they look like a flower spray, stem is long and slender.

6. The leaves are in the shape of an arrow.

7. Pictures can be found in various places.

8.- 9. No questions.

10. See Pond Life published by Golden Press, p. 57, for a diagram. Other reference will also have the diagrams.

11. No questions.

12 - 13. Refer to #10 above.

Bryophytes

14. No questions.

15. See Pond Life published by Golden Press for an example.

Submerged Water Plants

16. No question

17. a. They have bladder-like traps.
b. Because of the bladder-like traps.

18. a. Filament - thread-like.
b. See Pond Life published by Golden Press, p. 34.

19. Elodea have branched stems - narrow leaves are arranged in whorls of 3 or more.

Some Aquatic Animals

*Protozoa - (Protozoa live in many types of aquatic habitats)

1. Protozoa Characteristics:

One-celled animals that are usually microscopic.
They have many different shapes.
They have several methods of movement: eg., amoeboid, cilia, fagellum

2. They are very small and simple animals.
They are animals that have only one cell.

3. They live in many types of aquatic habitats:

Shallow water in and around plants.
On the surface as zoo planton.
On the bottom.
In stagnant pools.

4. Amoeba, Paramecia, stentor, vorticella, epistylis (these are a few of the common protozoa students will find pictures of - there are many others).

*Rotifers

1. Tiny animals --- many are microscopic. Most have a ciliated disc at the anterior end (head). In some species the disc like cilia move like a revolving wheel. This is how they get the name wheel animicules.

   They are sometimes mistaken for protozoa. Protozoa are one-celled, rotifers are not. In rotifers you can see the intestines, etc. You can't in protozoa. (Protozoa do not have them.)

2. Because in some varieties the cilia, when active, looks like a rotating wheel.

3. They occur in an endless variety of habitats. They are found in all types of quiet waters. Aquatic and semi-aquatic habitats. Large puddles, deep regions of lakes. Even in flower urns that have been outside.

4. Protozoa are one celled. Rotifers are many celled. YOU CAN SEE THE INTERNAL ORGANS (INTESTINES) OR ROTIFERS. Rapid wheel-like movement of cilia in the anterior region (head) of rotifers. Label your diagram.

5. Philodina and keratella are two common diagrams of rotifers that are found in many books. There are many others.

*Coelenterates

1. Hydra

2. Sea anemones, corals, jelly fish, hydra (sea anemones, corals, jelly fish are sea animals) Hydra are fresh water coelenterates.

3. Body is elongated cylinder.
   They have tentacles.
   They have special stinging "cells" (nematocysts) to sting their prey. (They paralize their prey.)
   The nematocysts are located on the tentacles.
   They attach themselves to a submerged base.
   They move by "inching" slowly with their foot; or
   They turn end over end (summersaulting movement).
   They eat crustaceans, one-celled animals, worms, and other tiny animals.

4. Tentacles - long slender growth around the head or mouth. Hydra use them to catch food and to put food in their "mouth".

5. 2-25 mm long. (usually less than an inch)

6. Unpolluted water of ponds, lakes, streams, spring-fed streams. They usually can be found attached to stones, twigs, vegetation, (leaves) or debris.

7. See A Golden Guide Pond Life, p. 78. Diagrams can be found in several references.

Waterbears

2. Because of it's shape and the claws on their legs.

3. See p. 119 of Golden Guide Pond Life for diagram.

Flatworms (Turbellaria)

Planaria

1. Characteristics:

   a. Elongated, flat bodies.
   b. They are free-living worms - they glide along on objects.
   c. Mouth is on underside of the body. It is the only opening to the digestive tract.
   d. They have large eye spots in the head region

   One Unusual Characteristic:

   If the body is cut or divided in half, each of the two parts will become a complete animal. (You might find some interesting pictures of this.)

2. Shallow water - some kinds are found in shallow spring fed streams. During the day, they will be under stones, leaves and other submerged objects.

3. They eat small animals (living and dead). (In lab, they will eat pieces of beef liver or chopped up earthworms and meal worms.)

4. See a Golden Guide to Pond Life, p. 84.

Annelida (Segmented Worms)

Leeches

1. Segment - parts into which a body is separated or divided. (The earthworm is an example of an animal that is segmented.)

2. Segmented bodies - bodies shaped like a tube. (These are the external characteristics. Some students might list the internal characteristics.)

3. Flatened segmented worms - have a mouth and tail sucker. They move like inchworms.

4. Water edge - Places where water is shallow and there is little movement. They can be found hidden under logs, stones, vegetation and debris.

5. See A Golden Guide, Pond Life, p. 83.

Phylum - Arthropoda

1. No question

2. Segmented body, jointed legs, antennae----

3. Crustacea (eg. crayfish) Insecta (insects) Collembella ((spring tails) Arachnida (spiders)

Phylum - Arthropoda

Class - Crustacean

1. Segmented body, jointed legs, 2 pairs of antennae, breathe with gills. Have 2 main body divisions (the head and thorax are fused), one leg per body segment.

2. Clam Shrimp, isopods, crayfish, copepods, sideswimmers, and water fleas.

Phylum Arthropoda
Class Crustacean
Order Amphipoda
Genius Gammarus (side swimmer)

1. They swim sideways.

2. Habitat: Unpolluted clearwaters, springs, spring-fed streams, pools, ponds and lakes.

Phylum - Arthropoda
Class - Crustacean
Order - Copepoda

*Copepods

1. Very small - .3 - 3.2 mm. They look like tiny specks darting through the water.

2. Most are gray or brownish in color.
Cylindrical shaped body - body is divided into head, thorax and abdomen.
Have 5 or 6 appendages.
Body is segmented.

3. Fresh water - ponds, lakes, pools. In planton. They are not numerous in rapid moving streams.

Phylum - Arthropoda
Class - Crustacean
Order - Decapoda

*Crayfish (Decapoda)

1. No question.

2. Habitat: Usually shallow water. In the daytime adults hide in burrows and under rocks. At dusk, you can find them on banks of streams. Immature crayfish will crawl on the bottom and in vegetation during the day time.

3. Carapace over the head and thorax. 5 pairs of walking legs. First pair of legs have large pincers for holding and tearing food.

4. Food - mainly plants. They will eat animal food also.

Phylum - Arthropoda
Class - Crustacean
Order - Cladocera (water fleas)

*Water Fleas

1. No question

2. Round or oral shaped shell. Head looks like a beak, head bent downwards. Antennae. You can see the internal structures under a microscope.

3. Nearly all types of fresh water.

4. See Pond Life published by Golden Press, p. 89.

Phylum - Arthropoda
Class - Insecta
Order - Collembella (spring tails)

*Spring Tails

1. - 2. No questions.

3. See Pond Life, p. 101 or Pond Guide, p. 16.

Phylum - Arthropoda
Class - Insecta
Order - Odonata
Suborders - Anisoptera and zygopter,(dragonflies and damselflies.)

*Dragonflies and Damsel Flies

1. No question.

2. The damselflies have a thinner body than dragonflies.

3. Damselflies have 3 leaf like gills at the tip of the abdomen. Dragonflies do not have these gills. The damselflies are more slender than dragonflies.

*Hemiptera (He Nip Ter uh) THE TRUE BUGS

2. Characteristics: Have piercing and sucking mouth parts. Some have mouth parts that look like "beaks". Half of the wing is leathery (hard) and half is membranous (soft). You can only see half of the wing. Some are aquatic. They vary in size and shape.

> ANY TIME YOU SEE AN INSECT WITH X-SHAPED WINGS ON ITS BACK AND PIERCING ("beaks") MOUTH PARTS, THE INSECT IS A TRUE BUG.

3. One half is leathery (hard), the other half is membranous soft.

4. They have piercing mouth parts that look like beaks.

The Water Measure

1. - 5. SEE THE ILLUSTRATIONS ON HEMITERA for this drawing.

*Giant Water Bug

1. They are a large bug. (3-6 inches long.)

2. All kinds of aquatic life. Even larger animals like tadpoles, small frogs and small fish.

3. No question.

4. Shallow ponds and lakes. At night around electric lights that are near water.

5. Drawing - see illustrations of the water bugs.

*Water Striders

1. The surface of quiet lakes and ponds.

2. Skate or glide across the surface.

3. Drawing --- See illustrations of water bugs.

*Water Boatman

1. No question.
2. The hind legs are long and flattened so they can be used like oars.
3. They swim with an oar-like movement.
4. No question.
5. Same as the information given in number 4.
6. Drawing - see illustrations.

Back Swimmer

1. They (it) always swims on it's back.
2. Ponds, lakes, back waters of streams.
3. Trace a diagram (picture) of a back swimmer. Label your diagram.

Coleoptera (Beetles)

1. - 2. No question.
3. Sheath wing.
4. Thick heavy front wings that cover the membranous soft wings.
5. They have chewing mouth parts -
6. To bite -
7. Because they have special mouth parts for chewing.
8. Water beetles have a line down the middle of their back. (This is because of the kind of wings they have.) Water bugs have an X-shape on their back because of the kind of wings they have. Water beatles have chewing mouth parts. Water bugs have piercing mouth parts that look like beaks.

Crawling Water Beetle

1. - 4. No questions.
5. Refer to the illustrations provided for an example.

Predaceous Diving Beetle

1. No question.

2. Usually have the tip of their head down in water and their abdomen above the surface. You can see a silver bubble around it's abdomen. This is an air bubble.

   They swim with a breast-like stroke.

   They have antenna that look like a whip.

> TEACHER NOTE:
>
> Students may not find all of the above answers - this is clarified when they do the exercise on the water scavenger beetle.

3. Near the bottom in the shallow water of quiet pools and ponds. They live where there are water plants.

4. See illustrations for an example.

Water Scavenger Beetles

1. No questions.

2. Animal that eats decaying organic (living) matter (things).

3. In shallow water where there is lots of plants -

4. By the way they swim:
   a. Diving beetles swim with a breast stroke.
   b. Water scavenger beetles swim with a crawl movement.
   c. They are poor swimmers.

   By their antenna:
   a. Diving beetles have a whip-like antenna.
   b. Water scavenger - beetles have a club-like antenna.

   Water bubble:
   a. Diving beetles have a silver bubble at the tip of their abdomen.
   b. Water scavenger - beetles do not. (They trap air under their wings.)

5. See illustrations provided for an example.

Whirigig Beetle

1. - 2. No questions.

3. They float or glide around in irregular curves. When they are When they are alarmed they dive or whirl around.

4. Because of the way they whirl around or swim on the surface.

5. They give off an odor that smells like apples.

6. See the illustrations provided for an example.

Phylum - Arthropoda
Class - Insecta
Order - Diptera
Family - Culicidae

*Mosquitoes

1. No question.

2. Surface of quiet water in ponds and temporary pools.

3. Larvae breathe through gills of abdomen. Thorax segments are thicker than the rest of the body. They have brushes at the tip of the abdomen (tail).

Phylum - Mulluska
Class - Gastropoda

*Snails

1. No question.

2. Characteristics:

a. shell might be round, flat or spiral.
b. the head has tentacles that can be extended or contracted.
c. eye at the base of each tentacle.
d. they crawl on a muscular foot that is located on the underside of the body.

3. Snails can be found in almost any type of water environment. They are usually found creeping on all types of surfaces under the water. (They can be found under water from 2 cm to 2 m deep.)

4. Because the foot is located on the snails underside (the "stomach").

Phylum - Mulluska
Order - Pelecypoda (clams)
Family - Spheridae (fingernail clams)

1. - 2. No questions.

3. Small creeks and shallow areas of some ponds.

4. Very thin and fragile.

Diving Beetle Aquarium

Things to observe:

1. Silver
2. Tip of abdomen -
3. To get oxygen-
4. With a breast stroke -
5. Buggy whips
6. There probably will be changes in the plants and in the number of snails.
7. This will vary.
8. No question.

Water Scavenger Beetle Aquarium

1. No

2. Yes - you should see it under the abdomen or around it. They trap oxygen under their wings.

3. Should be the head.

4. Crawl

5. Clubs

6. The appearance of the aquarium will probably change.

7. Will vary.

8. No questions.

9. The club like antenna. How it swims - crawls. When it comes to the surface its head touches the surface.

Water Scorpian Aquarium

Things to observe:

1. They catch food with their front legs.
2. They might swim with them. They are poor swimmers.
3. The end of the abdomen.
4. Probably through breathing tubes.

Giant Water Bug Aquarium

Things to observe:

1. Clings to an object --- tip of abdomen is in contact with the surface.

2. Probably yes.

3. Long, flat, they have cilia or bristles on them.

Water Boatman Aquarium

Things to observe:

1. The front legs
   a. one-segmented, flat, scooplike and have a fringe of bristles.
   b. The middle legs: long, slender, have claws on the end.
2. Hind legs: long, flattened and fringed for swimming.
3. The hind legs.
4. Quick darting manners --- oar-like movements of the hind legs.
5. Because of the oar-like movements of the hind legs.
6. They anchor themselves with the claws at the second pair of legs.
7. Yes - Air --- it is a film of air.

Observing Hydra

1. Most of them will be less than 2.5 cm. (1 inch)
2. Probably white or grayish.
3. Long flexible growths around the mouth of the hydra.
4. Probably 5.
5. To sting and paralize the prey.
6. Permanently attached -- not free to move about.
7. Stay in one spot.
8. No question.
9. The students should find some. (If hydra are fed daphnia their budding will increase.)
10. Diagram of a hydra. Diagram should have a title.

Observing Planaria

1. a. Color will depend on the species collected. Some will be of uniform color - dark brown to black. Another

species they might find will be more or less brownish and have a highly spotted pigment pattern.

b. Depends on the species collected. See the answer to a. above.

2. Moves and glides. (It does not crawl.)

3. It goes away from light.

4. They are sensitive to light. (They don't like light.)

5. Should be yes.

6. Flat bodied head is triangular shaped. Have large eye spots on the head. Mouth is on the underside of the body. It is the only opening to the digestive tract. Elongated body.

7. Diagram.

ACTIVITIES

DEFINITIONS OF AQUATIC TERMS

The words listed below have something to do with aquatic life or with aquatic habitats. Use the glossaries of science tests and other references to define these terms:

1. Aquatic
2. Habitat
3. Environment
4. Stream
5. Pond
6. Pool
7. Lake
8. Marsh
9. Stagnant
10. Debris
11. Surface
12. Food Web
13. Plankton
14. Phytoplankton
15. Zoo plankton
16. Phylum
17. Limnology
18. Limnologist

FOOD PYRAMID

Ponds are good places in which to learn the relationships of plants and animals. There is a linkage between plants and animals. A common linkage between plants and animals is food production (making) and food consumption (eating).

The words below are often used to explain the food pyramid. Use science texts, classroom books, encyclopedias and other references to define these words.

1. Herbivore
2. Carnivore
3. Plankton
4. Phytoplankton
5. Zoo plankton
6. Consumer
7. Producer
8. Find a picture of a food pyramid. (Find an aquatic food pyramid if you can.) Write the names of the plants and animals found in each section. Answer the following questions about a food pyramid:
9. What plants are at the bottom of the pyramid?
10. What animals are at the bottom of the pyramid?
11. Why is phytoplanton important to animal life in a pond?
12. Are carnivores or herbivores at the top of the food pyramid?
13. a. What do carnivores eat?
    b. Why do you think carnivores are toward the top of the pyramid?
14. Are the producers (food makers) in the food pyramid plants or animals?
15. Are the consumers in the food pyramid plants or animals?

Part B: Further Research (Optional Activity)

Use science texts, classroom texts and other reference to find information about an aquatic food chain. Write a report about an aquatic food chain.

Part C: Further Research (Optional Activity)

Write a report on an aquatic food web.

*ALGAE

Use science books, classroom books, encyclopedias and other references to find information on algae. Take notes - use your information to find the answer to these questions.

1. What are algae?

2. What habitats can algae be found in?

3. List the major groups of fresh water algae.

Blue-green algae: Find information about blue-green algae. Answer the following questions.

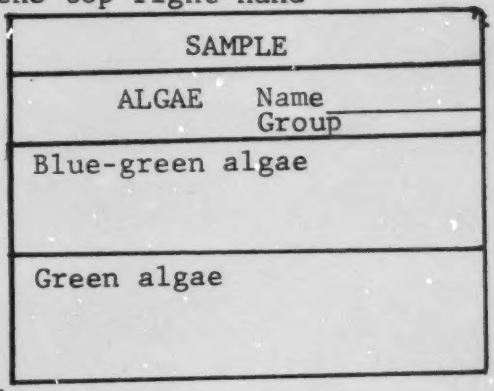
4. What are the characteristics of blue-green algae?

5. Why is it called blue-green algae?

6. Sometimes the presence of blue-green algae is a clue that the water might be polluted. What is one of the habitats of blue-green algae?

7. What happens when too much blue-green algae grows in a pond?

8. a. Get a piece of tracing paper.
   b. Put your name and group number in the top right hand corner of the page.
   c. Put the word ALGAE at the top of the page as the title. See sample.
   d. Now write the title Blue-green algae on the left side of the paper. Toward the top.
   e. Keep this tracing paper for future drawings.



9. Find some pictures of blue-green algae.

10. Trace or draw a picture of oscillatoria.

11. Trace or draw a picture of one other blue-green algae. Remember to keep the tracing paper for future drawings.

Green Algae

12. What are the characteristics of green algae?

13. Get the tracing paper you used for the blue-green algae drawings. Use a straight edge to draw a horizontal line under your blue-green algae drawings. (Draw the line across the page.)

14. Write the title Green Algae under this line.

15. Use various books to find pictures of green algae. Trace or draw pictures of the following algae:

Chlorella	Pediastrum
Spirogyra	Hydrodictyon
Cladophora	Scenedesmus
	Desmid

Label each drawing.

16. Draw a horizontal line across the paper under the green algae drawings.

Diatoms (Yellow-green algae)

17. What are the characteristics of diatoms?

18. Diatoms look something like desmids. How are diatoms different from desmids? (Hint: What are the characteristics of desmids? How are they different from diatoms?)

19. Get the tracing paper you used for your other drawing. Title this section Diatoms.

20. Find pictures of diatoms. Draw or trace 3 kinds of diatoms. Label each drawing.

21. Attach your drawings to the back of this assignment.

22. Note: If you are looking for diatoms look for stagnant, shallow water of ponds. If you see a film on the top of the water that looks like oil you have a good chance of finding diatoms in the water. Take your samples from the surface and from the bottom.

HABITATS OF POND AND LAKE PLANTS

Use science books, classroom books, encyclopedias and other references to answer the questions in the following exercises.

Plants that Grow on the Shore

The shore is the land near the edge of the water. You can find horse tails and sedges on the shore of some lakes and ponds.

Horsetails

1. a. What do horsetails look like?
   b. Why do you think they are called horsetails?

Sedges

2. What do sedges look like?

Emergent Plant Zone

Emergent plants grow near the shore. These plants are rooted to the bottom. They have stems and leaves above the surface. Most of the emergent plants are grasses, sedges or rushes. Frogs, birds and mammals find shelter here. You can also find algae, protozoans, worms, insects, snails and other animals on and/or around the stems of these plants. Examples of some plants in the emergent zone are: cattails, rushes, water plantain and arrowheads.

Cattails

3. Cattails can also be found in some roadside ditches.
   a. What does this tell you about the amount of water in some roadside ditches?
   b. Describe (tell) what this plant looks like.

Rushes

4. Spike rushes and bull rushes live in the emergent zone.
   a. Use a dictionary to define the word spike.
   b. Use reference books to find out what the stems and flowers of bulrushes are like.

Water Plantain

5. What do water plantains look like?

Arrowhead

6. What do the leaves of arrowheads look like?

7. Draw a picture of an arrowhead leaf in the space below. Label your drawing Arrowhead Leaf.

Floating Water Plants

8. You can find waterlilies and duckweed in this zone. Some stagnant or very quiet pools can become covered with a "blanket" of duckweed. Duckweed grows in quiet water.

   Duckweed

   Duckweed is the smallest flowering plant. You might be able to find 3 kinds of duckweed. The three kinds are: Great Duckweed, Lesser Duckweed and Wolffia.

9. Wolffia

   Scientists think Wolffia is the smallest seed plant. Find a picture of wolffia.

10. Draw a picture of wolffia in the space below. Label the diagram.

11. Great Duckweed (Spirodelia)

    Great duckweed has several rootlets hanging from it.

12. Draw a picture of Great Duckweed (Spirodelia) in the space below. Label the diagram.

13. Lesser Duckweed (Lemna Minor)

    Lesser duckweed has one rootlet hanging from it. Draw a picture of lesser duckweed below. Label the diagram.

Bryophytes

14. Bryophytes float much like duck weed. However, they are not seed plants. Liverworts and mosses are bryophytes. Aquatic bryophytes can be found near the shore in shallow water. They can be found in marsh areas.

15. Draw a picture of a bryophyte. (Riccia and Marchantia are two that can be found in this area.)

Submerged Water Plants

16. This is the innermost group of plants in a pond. Pond weeds, bladderworts, filamentous algae, elodea, and horn worts are some of the plants that can be found in this area of the pond.

17. Bladderworts

Bladderworts can be found in some ponds or pools of quiet water.

a. What are the branches of this plant like?
b. How do you think it gets its name?

Filamentous Algae

18. Filamentous algae belong to the green algae group.
    a. Look up the meaning of filament
    b. Spirogyra and Mougeotia are examples of filamentous algae. Draw pictures of spirogyra and mougeotia in the space below. Label your diagrams.

Eloden (Anacharis)

This plant is often submerged in slow running water or in a pond. Sometimes it is free floating.

19. What does this plant look like?

Pond weeds

This is the largest group of aquatic seed plants. They are rooted to the bottom. They grow almost completely submerged. Some leaves are above water and some are below. The leaves are different shapes. The flowers are above water. Find some pictures of different kinds of pond weeds.

Platyhelmenthes

Flat worms (Turbellaria)

Planaria are flatworms.

1. List the characteristics of flatworms.

2. What is the habitat of planaria?

3. What do planaria eat?

4. Draw a picture of planaria in the space below. Label your diagram.

Annelida (Segmented Worms)

Leeches

1. What does the word segment mean?

2. What are the characteristics of Annelids?

3. Leeches are segmented worms. List the characteristics of leeches.

4. What is the habitat of leeches?

5. Draw a picture of one kind of leech in the space below.

SOME AQUATIC ANIMALS

*Protozoa

Use science texts, classroom books, encyclopedias and other references to find information on protozoa. Use the information you find to answer the questions below.

1. List the characteristics of protozoa.

2. The word protozoa comes from two Greek words pro and zoa. Pro means before and zoa means animal life. Why is protozoa a good name for these living things?

3. Where can you find protozoa. (What is their habitat?)

4. List at least 5 kinds of protozoa.

5. Draw an example of one kind of protozoa in the space below. Label your diagram.

*Rotifers

1. List the characteristics of rotifers.

2. Rotifer comes from two Latin words: rota and ferr. Rota means wheel and feer means to bear. Sometimes rotifers are called "Wheel Animalcules". Why do you think they got this nickname?

3. Where can you find rotifers? (What is their habitat?)

4. How can you tell if you have a rotifer or a protozoa under the microscope?

5. Draw a diagram of a rotifer in the space below.

SOME AQUATIC ANIMALS

Coelenterata - Hydra

1. The word coelenterata means "hollow gut". Coelenterates have sac-like body with a hollow center. This hollow center or tube is the digestive tract. It is the only body cavity that these animals have. That is why this group of animals was named coelenterata (hollow gut). Most coelenterates live in sea water, but some live in fresh water.

2. List some examples of animals that are coelenterates.

3. What are the characteristics of hydra?

4. What are tentacles?

5. How big are hydra?

6. What is the habitat of hydra? (Where are they found?)

7. Find a picture of hydra. Draw or trace a picture of hydra in this space.

NOTE:

8. If you are lucky, you can find hydra in this area. (Remember its habitat.) If you find them, they may be the American Hydra. The scientific name for it is Hydra Americana. It is whitish to tan in color. There are 5 tentacles in this kind of hydra. The tentacles are shorter than the rest of the body.

Waterbears (Tardigrada)

1. Habitat of waterbears: Waterbears live among plants, algae or in mud and debris of ponds and lakes.

2. Find a diagram (picture) of a waterbear. Why do you think this animal is called a waterbear

3. Draw a picture of a waterbear in the space below. Label it. (This may be hard for you to draw. Get a small piece of tracing paper and trace it if you wish. Glue or staple your drawing to this sheet.)

*Phylum - Arthropoda

1. Arthropoda means jointed foot. All arthropods have jointed legs.

2. List the characteristics of arthropods.

3. List the classes of arthropods.

Phylum-Arthropoda

Class-Crustacean

1. List the characteristics of crustaceans.

2. List some animals that are crustaceans.

Phylum-Arthropoda
Class-Crustacean
Order - Amphipoda
Genus - Gammarus (Side swimmers) (Seuds)

1. Why are these animals called side swimmers?

2. What is the habitat of side swimmers?

Phylum-Arthropoda
Class-Crustacean
Order-Copepoda

*Copepods

1. How big are copepods?

2. What do copepods look like?

3. What is the habitat of copepods?

Phylum-Arthropoda
Class-Crustacean
Order-Decapoda

*Crayfish - Decapoda

1. Read about crayfish and where they live.

2. What is the habitat of crayfish?

3. What are the characteristics of crayfish?

4. What do crayfish eat?

Phylum-Arthropoda
Class-Crustacean
Order-Cladocera (Water flea)

*Water Fleas

1. Read about water fleas

2. What are the characteristics of water fleas?

3. What is the habitat of water fleas?

4. Note: A common water flea that you might find is daphina. Find a picture of a daphina. Get a small piece of tracing paper. Trace a picture of a daphina. Paste or glue your picture on this sheet. Label your picture.

P.S. If you like to draw...you may draw the diagram in this space.

Platyhelmenthes

Flat worms (Turbellaria)

Planaria

1. List the characteristics of flat worms.

2. What is the habitat of planaria?

3. What do planaria eat?

4. Draw a picture of planaria in the space below. Label your diagram.

Phylum-Arthropoda
Class-Insecta
Order-Collembolla (Spring tails)

Spring tails

1. Habitat: These insects are not truly aquatic. However, they are often found on the surfaces of back waters of ponds, lakes, and rivers. They are found in marshes. (They occur in damp surroundings of the waters edge.) Spring tails can also be found on the damp forest floor.

2. Characteristics:

These are primitive wingless insects. Spring tails get their name from an appendage they have on their abdomen. When this appendage is released it acts like a spring and throws the insects into the air. This is why the insects are called spring tails. They are fun to watch in water.

3. Find a picture of a spring tail. Draw a diagram of a spring tail in the space below.

Phylum-Arthropoda
Class-Insecta
Order-Odonata
Suborders-Anisoptera and zygoptera
Dragon flies and Damsel flies

*Dragon flies and Damsel flies

1. Read about dragon flies and damsel flies.

2. How is the body shape of a dragon fly different from the body shape of a damsel fly?

3. How is the body of a dragon fly nymph different from the body shape of a damsel fly?

Phylum-Arthropoda
Class-Insecta
Order-Hemiptera

*Hemiptera (Henip ter uh) - The True Bugs

1. Hemipter comes from 2 words hemi meaning half and ptera meaning wing. You can always see the front wing of these insects, but you can't see the hind wing. This is why they have the scientific name Hemiptera because you can only see half of the wing. Many insects are called "bugs" but this is the only group of insects that scientists call bugs. This is why some books you read call them the true bugs.

2. What are the characteristics of Hemiptera. (The true bugs)?

3. What are the wings of Hemiptera like?

4. What are the mouth parts of Hemiptera like?

The Water Measure

1. These insects are often not found on field trips because they are hard to see. They hide in thick plant growths on the surface of water and ponds.

2. a. Get a piece of tracing paper.
   b. Put your name and group number in the top right corner.
   c. Put the title Hemiptera - The True Bugs at the top of the page.

3. Find a picture of a water measure or use the reference sheet your teacher provides.

4. Trace a picture of the water measure on the tracing sheet. Please use the space wisely. You will need the tracing paper for other pictures.

5. Put the title Water Measure above your drawing.

*Giant Water Bug

1. Why do you think these insects are called giant water bugs?

2. What do these insects eat?

3. Habitat: You can find these insects on the bottom of shallow ponds and lakes. Sometimes you can find them near the surface. When they are near the surface they cling to an object for support and the tip of the abdomen is in contact with the air. The male insects fly from one pond to another. Usually they will turn up on ground underneath lights. (Some people call them "electric light" bugs because they come near lights at night.

4. List two places you could find giant water bugs.

5. Use the same piece of tracing paper that you used for the water measure. Trace a picture of a giant water bug. Label your diagram.

*Water Striders

1. Water boatman got their name because of the way they swim and because of the shape of their legs.

2. How does the shape of a water boatman's legs help it to swim?

3. Why do you think this insect got the name water boatman?

4. You can find water boatman in shallow water of ponds, lakes or streams. They spend most of their time under water.

5. Trace a picture of a water boatman. Label your drawing.

*Back Swimmer

Read information about back swimmers.

1. Why do you think this insect is called back swimmer?

2. Where could you find back swimmers?

3. Trace a diagram (picture) of a back swimmer on the tracing paper. Label your diagram.

4. Note: If you try to hold a back swimmer in your hands, you could get bitten. THEIR BITE IS PAINFUL. HANDLE WITH CARE.

*Coleoptera (Beetles)

1. Coleptera comes from two Greek words. The word means sheath wing. (Sheath means to enclose or protect.) The common name for an insect belonging to this calss (Coleoptera) is beetle. Beetle comes from a word that means to bite. All Coleopteras (beetles) have strong mouth parts. The mouth parts are used for chewing.

   You can always tell a beetle from a bug by looking at the wings and mouth parts. Beetles will have a line down their back, and tough wings cover the soft wings. Beetles have chewing mouth parts. The bugs have an x-shape on their backs and only half of their wing is hard. Bugs (Hemioptera) have piercing mouth parts that look like beaks.

2. Review the infomation in Number 1.

3. What does coleoptera mean?

4. The word Coleoptera gives us a clue to the kind of wings the insect has. What are the wings like?

5. What are the mouth parts of coleoptera like?

6. What does the word beetle mean?

7. Why do you think these insects are called beetles?

8. How can you tell a water beetle from a water bug?

Crawling Water Beetles (Halipidae)

1. These insects are small. Many people do not find them because they are so small. They live in shallow water among plants. Crawling water beetles are yellow or brown colored and usually have black marks.

2. a. Get a piece of tracing paper.
   b. Put your name and group number (or class) in the top right hand corner.
   c. Put the title Coleoptera (Beetles) at the top of the page.

3. Find a picture of a crawling water beetle or use the reference sheet pictures your teacher provides.

4. Trace a picture of the crawling water beetle. Please use the space on your tracing paper wisely - you will need the tracing paper for other drawings.

5. Put the title Crawling Water Beetle above your drawing.

*Predaceous Diving Beetle (Dytiscidae)

1. These insects are usually easy to collect. However, you must know their habitat so you can find them. You can find them in most pools and ponds where the water is still. You usually cannot find them in large lakes. Look in shallow water near the bottom. They live where there are plants.

2. What are the characteristics of the diving beetle?

3. Where do diving beetles live?

4. Trace a picture of a diving beetle on the tracing paper. Write the word Diving Beetle above the picture.

*Water Scavenger Beetle (Hydrophilidae)

1. You can find water scavenger beetles in shallow water where there is lots of plants. Water scavenger beetles look something like diving beetles. However, water scavenger beetles are poor swimmers and diving beetles are good swimmers. Watch the beetle swim. Water scavenger beetles crawl in water. Diving beetle move or swim with a "breast" stroke. The antenna of water scavenger beetles are club-like. The antenna of diving beetles are whip-like. Water scavenger beetles do not carry a bubble at the tip of their tail. Diving beetles do.

2. What does the word scavenger mean?

3. Where can you find water scavenger beetles?

4. How can you tell a water scavenger beetle from a diving beetle?

5. Trace a picture of a water scavenger beetle. Remember to put a title for your drawing.

*Whirigig Beetles (Gyrinidae) (Apple bugs)

1. Whirigig beetles are found on the surface of lakes, ponds, slow streams and the back waters of rapid streams.

2. Read about the whirigig beetle. Find out how it swims.

3. How does the whirigig beetle swim on the surface?

4. Why do you think it is called the whirigig beetle?

5. Sometimes these insects are called apple bugs. What do these beetles smell like when you pick them up?

6. Note: This beetle has some interesting eyes - Under a microscope you can see two pairs of eyes. One pair is for looking up in the air and the other pair is for looking in the water. They can look in the air and in the water at the same time! Sometimes they are called apple bugs. When they are picked up they give off an odor like apples.

7. Trace a picture of a whirigig beetle. Don't forget to put the title Whirigig Beetle by your drawing.

Phylum-Arthropoda
Class-Insecta
Order-Diptera
Family-Culicidae (Mosquitoes)

*Mosquitoes

1. Mosquitoes lay their eggs in water. Their larvae and pupae are aquatic. Find information on mosquito larvae.

2. What is the habitat of mosquito larvae?

3. What are the characteristics of mosquito larvae?

Phylum Mulluska
Class-Gastropoda

*Gastropods (Snails)

1. Snails belong to the class gastropods. Gastropoda means stomach foot.

2. What are the characteristics of gastropods?

3. What is the habitat of snails?

4. Study the characteristics of snails. Why do you think scientists named them gastropods?

Phylum-Mulluska
Order-Pelecypoda (Clams)
Family-Sphneridae (Fingernail clams)

1. Habitat of Clams: Most pelecypoda are found in an unpolluted habitat. They are most abundant in large rivers. Fingernail clams can be found in small creeks and in shallow areas of some ponds.

2. Characteristics of fingernail clams:

   a. The shells of these clams is very thin and fragile.
   b. The shells have 2 valves (one takes food in and the other gets rid of wastes).
   c. They have no tentacles, head or eyes.

Use the information in #1 and #2 to answer these questions:

3. Where could you find fingernail clams?

4. What are the shells of fingernail clams like?

Name_____

Group_____

Partner_____

POND ACTIVITIES

General Observation of the Pond

1. Slowly and quietly walk around the pond. Carefully observe (see) the life in and near the pond.
2. What do you smell?
3. What do you hear?
4. List the living and non-living things you see in the pond in the chart below. Try to find at least 10 things.

LIVING	NON-LIVING

5. Were there any dead animals in the pond?
6. Were there any dead plants in the pond?

OBSERVING ANIMALS IN A SMALL AREA OF A POND

Walk around the pond. Find an area you want to observe. Observe the activities that take place in a small area of the pond. (About an area of 20 sq. cm in and outside the pond.) Include the air above the pond. Record your observations in the space below. Record at least 5 observations.

Activity Observed in and Around the Pond

Observation Number	Where it usually stays in the pond	How it moves in water (glides oar-like move-ment, dives, etc.	Name of the animal
1			
2			
3			
4			
5			
6			
7			

FIELD TRIP TO A POND, POOL OR STREAM

Equipment you need:

1. Plastic pail (Do not use metal containers. Most of the things you collect will die if put in metal containers.)

2. Baby food jars with lids (5)
   Other small jars will work too. Several baby food jars will fit nicely in a plastic pail. They can be carried in the pail if you plan on taking several samples.

3. Aquatic net (Some books have directions for making them).

4. Pencil (Please do not take pens with you).

5. Small pocket size note book
   It is not neceysary to buy one. You can make yourself one by cutting scrap paper this size. Staple them together.

What to wear:

Boots or old tennis shoes and old clothes.

*Note: ALWAYS USE AQUATIC NETS IN WATER - BUTTERFLY NETS WILL BREAK.

Equipment for Laboratory Study

Enamel pan (use mirical whip or other white plastic containers if you don't have an enamel pan.

Microscope, hand lens, depression slides, tweezers, eye dropper and reference books on aquatic life.

COLLECTING POND LIFE

If you are collecting samples outside of class as a special project or for enjoyment, you should follow these directions for best results.

-Carry your note pad and pencil in your pockets
-Carry the baby food jars in your plastic pail
-Carry your dip net and aquatic net

You should collect water from different habitats in the pond. The edge, surface, bottom, and open water.

Sample #1 The Edge of the Water (Shoreline)

1. Take a baby food jar scoop some water up near the edge of the pond. Sweep your aquatic net in this area. Check the contents. Sort out what you find and put them in the jar.

2. Take your pocket sized note book and write down Sample #1 - Edge of Water.

3. Then tear off a small strip of paper from your note book. Write the number 1 on it. Use Pencil. Put this strip of paper in the jar. You now have your jar marked so you will know what sample you have when you use it in the lab.

Sample #2 The Shallow Water

Repeat the procedure above. Be sure you use your net.

Sample #3 The Surface

Repeat the procedure in #1.

Sample #4 The Bottom

Repeat the procedure in #1. You will get best results if you use your aquatic net to scrape the bottom. Sort out what you find. Try more than once.

NOTE: THE ORDER IN WHICH YOU COLLECT YOUR SAMPLES IS NOT IMPORTANT. You can collect your samples from the various pond habitats in any order you want. WHAT IS IMPORTANT - is that you record the sample number in your note book and write down information about the habitat. Always take a strip of paper and write the sample number on it. Drop the paper in the jar and close the lid.

When you are finished put some extra pond water in the pail. About 1/3 of a pail.

Take your samples to the lab or home to study.

Name_____

Group/Section_____

Lab Partner_____

Lab - AQUATIC LIFE

Equipment for lab:

Microscope
Hand lens
Depression slides or regular slides with cover slips
Tweezers or forceps
Dropper
Enamel pan - if you don't have an enamel pan, use white plastic containers (eg. mirical whip).
Reference books on algae, protoza, etc.

Procedure:

Part A

When you get back from your field trip, take the lids off your jars. Follow the directions of your teacher if this is a class project.

If you are doing this as a special project, you should dump your jars in separate containers. Don't lose your sample numbers.

Part B Macroscopic Life - What you can see without a microscope)

Step 1 - get a lab sheet chart from your teacher and put your name on it.
Step 2 - record the sample number you are studying.
- record the habitat you got this sample from
Step 3 - study the plants and animals you can see without a microscope
- record information in the chart for each plant or animal you examine.
Step 4 - Repeat steps 1-3 for your other samples
- use a separate chart for each habitat sample

Part C Microscopic Life

Step 1 - use the charts you used in Part B. Begin with sample 1. Be sure and record your information on the same chart you used for sample 1 in Part B
Step 2 - Prepare a depression slide or a wet mount slide.

Step 3 - Examine the slide under the microscope. BE PATIENT if you don't find something right away. Slowly move the slide around. If you don't find anything on the slide, prepare another slide. If you can't find anything on this slide ask your teacher for help

Step 4 - Record what you see in the lab chart

Step 5 - Repeat steps 1-4 for the other pond samples you have

When finished with your laboratory work, put all equipment in its assigned place. Follow your teacher's directions for lab clean up. Thank you.

Part D Discussion of Laboratory Results

Use the habitat charts you filled out in the lab to answer the following questions.

1. List or describe the living things you collected from the edge of the water.

2. List or describe the living things you collected from the surface of the water.

3. List or describe the living things you collected from the bottom.

4. List or describe the living things you collected from open water.

5. Did you find any living plants or animals under rocks, twigs, or leaves? Yes_____No_____. If yes, what did you find?

6. Did you find in any plant or animal in more than one habitat? Yes_____No_____. If yes, what did you find and what habitats did you find them in?

7. What plants and animals did you find only on the bottom?

8. Which plants and animals did you find only on the surface?

9. Which plants and animals did you find only in open water?

10. Which plants did you find only on the waters edge?

Part E The Stream Habitats

11. Answer the following questions if you collected from a stream.

12. Did you collect anything from attached to or under rocks, twigs, or leaves? Yes_____No_____. If yes, what did you find?

13. What did you collect from running water?

14. What did you collect from the "calm" or non-running water of the stream?

15. What did you collect from back water pools?

AQUATIC LIFE LABORATORY RECORD SHEET

Sample Number	Habitat	Moves (Yes) (No)	Drawing

AQUATIC INSECT AQUARIUMS

General directions for making aquatic insect aquariums:

What you need:

Wide mouth jar (peanut butter jars will work. You can use larger wide mouth jars if you wish).

If you have a small glass aquarium bowl, use it. Larger aquariums will work too.

Sand

Screen for the top of your jar or aquarium. You will need a stick for some insects. (Do not put new lumber in the aquarium.)

Food for your insect.

Pond water - or tap water. If you use tap water, boil it to get rid of chloring, or let it stand for at least a day before using it.

How to set up your aquarium:

1. Put 3-5 cm of sand in the bottom of a jar.
2. If your teacher has not washed the sand you will need to wash it. It is important to wash the sand. It prevents molds and bacteria from growing.
   How to wash the sand: If you wash the sand at school, follow the directions of your teacher. If you wash the sand at home, wash it outside. Sand could clog some drains if you spill a large amount.

   a. Put about 3-5 cm of sand in the bottom of your jar.
   b. Run water in the sand until the water runs clear.

3. Fill your jar with pond water. It is best to use the pond water you collected your insect in. If you need to use tap water, boil it before using it in your aquarium, or let it sit in a container for at least a day. (This is necessary because chemicals in tap water can be harmful to pond life).

4. Some insects will need a stick to rest on (see fig.). Do not put new wood in your aquarium. It may have been treated with chemicals that are harmful to the aquatic life in your aquarium. Be sure your stick fits inside the jar.

5. Place a screen over the top of your aquarium.

Note: Before you make your aquarium, be sure you know two things:

1. Your insect's habitat.
2. What the insect eats.
3. Read information about aquatic insect aquariums before you set one up. There are some activity sheets that will give you directions. Some library books also have good information.

RAISING DRAGON FLY NYMPHS

Where to Find Dragon Fly Nymphs:

Collect them on the shore line, at the edges of ponds, or anywhere there is plenty of vegetation (plants) and leaves.

Collect the nymphs that have wing pads on their backs. Try to pick the ones with the biggest wing pads.

In May, the wing pads might look like they have hair on them. This is not hair, it is algae.

How to Set up Your Aquarium:

1. See the general directions for making aquariums. Follow them, then read the directions below.

   You will need a stick for this aquarium. This insect will need it to rest on and cling to when it is an adult.

2. Put one nymph in each aquarium. (They eat each other.)

3. Put a piece of screen over the aquarium.

4. Do not place the aquarium in direct sunlight. It should be in an area of the room that is shaded most of the time.

How to Feed Dragon Fly Nymphs:

1. Feed twice a week.

2. Cut a piece of thread long enough to reach the bottom of your jar.

3. Tie a piece of meat on the thread. (Hamburger, meal worms, etc.)

4. Put the thread in the water.

5. Move the thread around in the water so the nymph "sees" the food.

6. Don't feed the insect any more than it cleans up.

Things to Observe (see):

1. Watch what happens when the nymph gets excited. You should see it pump its' abdomen. This happens because the nymph

breathes with gills. The gills are located in the anus. When the nymph gets excited it breathes faster. This makes the abdomen "pump".

2. Watch the nymph when it opens its' mouth. What happens to the lower jaw?

DIVING BEETLE (Dytiscidae) Aquarium

Review the characteristics and habitat of diving beetles. (Use your work sheet on diving beetles.)

Where to Find Diving Beetles:

Habitat: You can find them in most pools and ponds, where there is no wave swept shores. They are usually in the shallow area near the bottom. (You will not find them in muddy water.) They need to be around plants.

Collecting Diving Beetles for an Aquarium:

1. Sweep an aquatic net over the bottom of the pond.
2. Collect some extra pond water. About one-third of a pail or a quart jar is enough.
3. Collect snails and some water plants. (Never put land plants in an aquarium.)

How to Set Up Your Aquarium:

Use the general directions for an aquatic insect aquarium. You will not need a stick if you put aquatic plants in your aquarium.

How to Feed Diving Beetles:

1. Diving beetles will eat snails.
2. If you don't have snails, give them meal worms to eat. DO NOT OVER FEED. This will ruin your aquarium.
3. They will eat almost any kind of raw meat.
4. If you have collected pond water with snails and some plants, you might not need to add food for a while.

Things to Observe:

1. Can you see a little bubble around the tip of the abdomen? What color is it?_____This bubble has oxygen in it. (If it is silver colored, it has oxygen.)
2. Watch this insect when it comes to the surface. Does the tip of the head or the tip of the abdomen touch the surface?_____
3. Why do you think the insect does this?_____

4. Watch how this insect swims. Explain how it swims.

5. Do the antenna look like buggy whips or clubs?_____

6. Watch the aquarium for a week or two. Record any changes in the appearance of your aquarium.

7. See how long you can keep your diving beetle living.

8. When you need to add water do not add tap water unless you have boiled it or let it set for overnight in an open container.

WATER SCAVENGER BEETLE AQUARIUM

Where to Find Water Scavenger Beetles:

Habitat: Quiet, shallow ppols and ponds where there is much vegetation (plants). Sometimes they leave the water and crawl on the land near the water edge.

Review the Characteristics of this Insect

(Use your worksheet on Water Scavenger Beetles)

Collecting Water Scavenger Beetles:

1. Use an aquatic net.
2. Collect some pond water when you catch these beetles.
3. Collect snails and some aquatic plants. (Don't put land plants in your aquarium.)

How to Set Up the Aquarium:

Use the general directions for setting up an aquatic insect aquarium.

How to Feed the Crawling Water beetle:

They will eat snails, meat, meal worms and plants (algae).

If you collected pond water with snails and algae in it, you might not need to add other food for a while.

Things to Observe:

1. Is there a bubble around the tip of the abdomen?
2. Do you see a silver color anywhere on the water scavenger beetle? Yes_____No_____. If yes, where do you see the silver color?

   Remember: If you see a silver color, this means the insect is carrying oxygen.

3. Watch the insect when it comes to the surface. Does the tip of the head or the tip of the abdomen touch the surface?

4. Watch how the insect swims. Does it have a crawl or a breast stroke?

5. Do the antenna look like buggy whips or clubs?

6. Keep checking your aquarium. Record any change in the appearance of the aquarium.

7. See how long you can keep your water scavenger beetle living.

8. Add water to your aquarium when you need to. Remember, don't add tap water unless you have boiled it or let it set in an open container.

9. Extra Challenge: How do you think you could identify this insect just by observing it in water?

WATER SCORPIAN AQUARIUM

Where to Find Water Scorpians:

Habitat: You can usually find them in trash and mud in the shallows of ponds, or in the grassy area of streams.

Collecting Water Scorpians:

1. You will find them in the habitat mentioned above.
2. Collect some extra pond water - B.
3. Be sure and get some snails and water plants with your water.

How to Set Up the Aquarium:

Use the general directions for setting up an aquatic insect aquarium. You will need a stick in this aquarium. Remember to put a screen over the aquarium.

How to Feed a Water Scorpian:

1. Cut a piece of thread long enough to reach in the jar.
2. Tie a piece of hamburger or a meal worm on the thread.
3. Dangle (or move around) in the water.
4. Deed once a week.

Things to Observe:

1. How does the water scorpian catch its food?
2. What does the water scorpian use its' middle legs for?
3. Watch this insect when it comes to the surface. What part of its' body usually touches the surface?
4. How do you think this insect gets its' oxygen?

GIANT WATER BUG AQUARIUM

Where to Find Giant Water Bugs:

Habitat: You can find these insects on the bottom of shallow ponds and lakes. Sometimes you can find them near the surface. When they are near the surface, they cling to an object for support and the tip of the abdomen is in contact with the air. The male of these insects flies from one pond to another. Usually they will turn up on ground underneath lights. (Some people call them "electric light" bugs because they come near lights at night.)

Collecting Giant Water Bugs for Your Aquarium:

1. You will find them in the habitat mentioned above.
2. If you find them in a pond, collect pond water. (If you use tap water, be sure it was standing for a while or boil it to get the chlorine out.)
3. Collect snails and some water plants.
4. Collect some tadpoles if you can.
5. Put these plants and animals in your aquarium.

How to Set Up the Aquarium:

Use the general directions for setting up an aquatic insect aquarium. You will need a stick in this aquarium. Put a screen over the aquarium.

How to Feed the Giant Water Bug:

These insects will eat all kinds of aquatic life. If you put tadpoles and snails in your aquarium, the giant water bug will eat them. They will also eat other aquatic insects or meal worms. This insect will kill fish. Do not put them in an aquarium with fish (unless you want some to disappear). They will also kill crayfish.

Things to Observe:

1. How does this insect get air (oxygen)?
2. Can you see a snorkel on this insect's body?
3. What are the legs of this insect like?

4. Make a list of the things this insect eats. Make a chart like the one below on your own paper. Record your observations in the chart.

Eating Habits of the Giant Water Bug

Date	Animals it Ate	Estimated Number it Ate

WATER BOATMAN AQUARIUM

Where to Find Water Boatman:

Habitat: Shallow ponds, shallow parts of lakes and streams. You can also find them in muddy stagnant pools. This insect spends most of its time on the bottom.

How to Collect Water Boatman for Your Aquarium:

1. Sweep an aquatic net across the bottom.
2. Collect extra pond water for your aquarium.
3. Be sure and get some of it from the bottom.
4. If there is algae in the area, collect some of it.

How to Set Up the Aquarium:

1. Use the general directions for setting up a pond aquarium.
2. Be sure to put a screen on top of the aquarium.
3. Put some algae in the aquarium.

How to Feed Water Boatman:

1. Feed them algae.
2. They will also eat protozoa and other microscopic animals.
3. If you have algae in your pond water you should be able to leave the aquarium without adding water for a while.

Things to Observe:

1. What are the front and middle legs of this insect like:
2. What are the hind legs like?
3. Which legs are used for swimming?
4. Explain how the insect swims.
5. Why do you think it got the name water boatman?
6. See if you can tell which pair of legs they use to anchor themselves to the bottom.
7. Can you see a silvery envelope around the insects body?

OBSERVING HYDRA

Where to Find Hydra:

Habitat: Shallow and unpolluted areas of ponds, spring fed streams, streams that are not spring fed, and rivers.

How to Collect:

The easiest way to collect hydra is to place leaves (or other objects they might be clinging to) in a jar of pond water. See if any hydra are present. Sometimes the underside of a leaf will have enough hydra for a whole class to observe. Please do not take more specimens than you need.

How to Keep:

(Hydra are harder to keep alive than aquatic insects. You will probably want to keep them for only a few days.)

1. Place the hydra in a semi-dark place. Eventually, the hydra will come to the top.
2. If you want to deep them for a while, they will eat daphina (water fleas) and copepods.

Things to Observe:

1. How long are the hydra?
2. What color are the hydra?
3. What are tentacles? (Hydra use them to gather food.)
4. How many tentacles do the hydra you found have?

   Note: OTHER KINDS OF HYDRA MIGHT HAVE A DIFFERENT NUMBER OF TENTACLES.

5. Hydra have special cells called nemate cysts. What are they used for?
6. These animals are sessile. Look up the meaning of sessile in the dictionary. What does it mean?
7. Watch the hydra move. Do they swim from one spot to another, or do they usually stay in one spot?
8. Hydra have an unusual way of reproducing. It is called budding. Find a picture of a hydra with some buds on it.
9. See if you can find some hydra with buds on them. Did you find any? Yes_____ No_____
10. Draw a diagram of a hydra in the space below.

OBSERVING PLANARIA

Where to Find:

Habitat: Shallow areas of springs, spring-fed streams, pools, marshes, ponds. Some will be free swimming, but most of the planaria will be found under objects in the shallow areas of the water. (If you are lucky, you can find planaria in our area.)

How to Collect:

Pick them off or wash them off the undersides of objects. (Leaves, rocks, sticks, etc.) If they are in plants like water cress, place the plants in the containers in the lab.

How to Keep for Laboratory Study:

1. You can keep planaria for a few days in a glass or enamel container.
2. Change the water every other day. (Tap water might kill them. Boil tap water before adding it or add tap water that has been sitting in an open container for at least a day.)
3. Put objects in the container. (Stones, pieces of flower pots.)
4. DO NOT PUT PLANARIA IN DIRECT SUNLIGHT.

Note: It is easier to keep these for a day or two unless you are interested in a challenge and in studying them. You must take proper care of them or they will die.

What They Eat:

1. They will eat cubes of fresh meat. Beef liver is their favorite! Planaria will also eat pieces of earth worms or chopped meal worms.
2. Remove the food fragments after 2 or 3 hours. Use a pipete (dropper). If they are in water that is not areated, the water should be changed.

Things to Observe:

1. a. What color is your planaria?
   b. Is it spotted or uniform in color?

2. Watch a planaria swim. Describe how it moves.

3. Shine a light (use a flashlight) on a planaria. What does it do?

4. Why do you think these animals like to hide under objects?

5. Look at a planaria's head. Do you see the large eye spots? Yes_____No_____. These are called eye spots because they are not real eyes. These spots are just sensitive to light. Planaria cannot see objects like we can.

6. Describe the shape of this animal. Is it round or flat bodied?, etc.

7. Draw a sketch of a planaria in the space below.

Further Research (Optional Activity)

Planaria can reproduce by regeneration. Read about this type of reproduction in planaria. Find pictures of regeneration experiments of planaria. See if you can find pictures of planaria with more than one head! Write a report about the Regeneration of Planaria. (Be sure and explain what regeneration means and how the experiments are done.)

AQUATIC LIFE MAZE

There are more than 20 kinds of aquatic life hidden in this puzzle. The words run horizontally, vertically, diagonally. See how many you can find. Some of the words are:

protozoa	beetle	isopod	diving beetle
rotifer	insect	frog	snail
algae	planaria	turtle	gastropod
water bear	leeches	copepod	apple bugs
hydra	arthropod	water flea	coleoptera
may fly	clams	giant water bug	zoo planton
cadis fly	crayfish	back swimmer	scud

P R O T O Z O A J C L A M L P L
B O H A C D G L I O K M N G Q E
A T B Y F H E G W P V T R I O E
C I F Y D X W A T E R B E A R C
K F B R C R Z E E P U K S N P H
S E A H O I A D F O G J L T M N
W R Z W O G B K C D G H Q W I D
I L K W A T E R F L E A J A O O
M M S N A I L S N O P K N T A P
M D D I V I N G B E E T L E E O
E P Q N S C U D R W X U O R G R
R L C S R O S T V W X R Y B Z H
H A O E T I P F S K J B D U B T
E N L C A S I O M U U V C G L R
L A B T B D C A D I S F L Y B A
T R B W U H O R H C A I S E T H
E A P T G R I W A P P L E U G
E M T Y Z O T M A Y F L Y L S
B E E T B C L L P Q F R E A Z
D C O L E O P T E R A I C E O B
Z O O P L A N T O N I V S M A I
L G A S T R O P O D O P E H F G

ILLUSTRATIONS

Hemiptera (Bugs) and Coleoptera (Beetles)

Figure 2.

Water strider
(Gerridae)

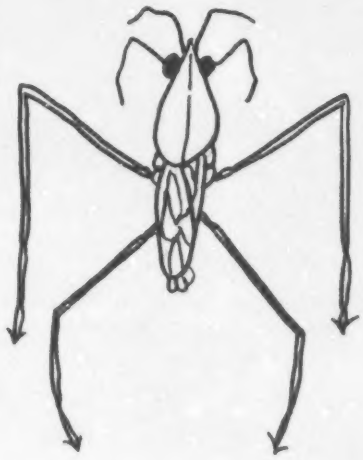


Figure 1.

Water measure
(Hydrometridae)

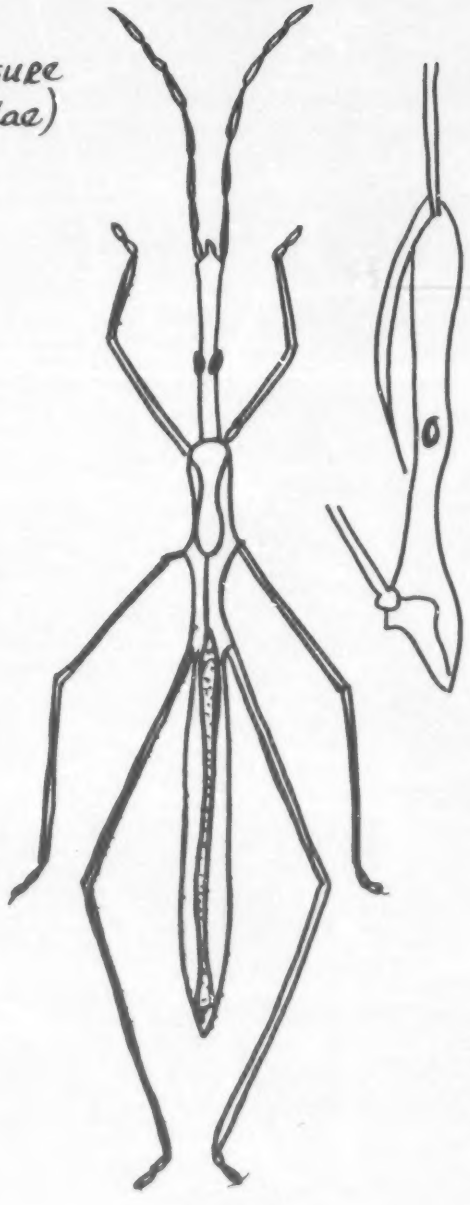
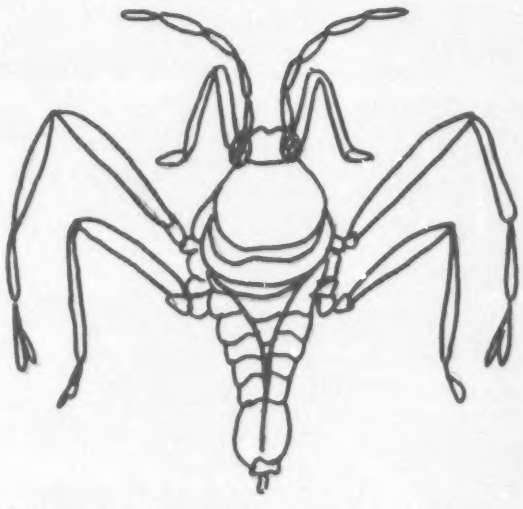


Figure 3.



Broad-Shouldered Water Striders
(Vellidae)
(also called "ripple bugs")

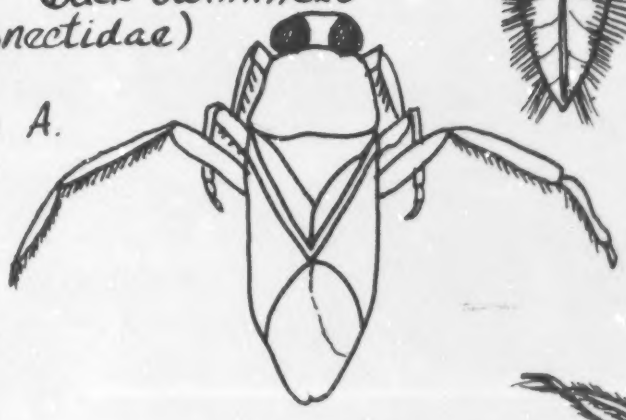
[Diagrams adapted from PENNAK]

Figure 4.

View B.

Back Swimmers
(Nononectidae)

View A.



Water boatman
(Corixidae)

Figure 5.

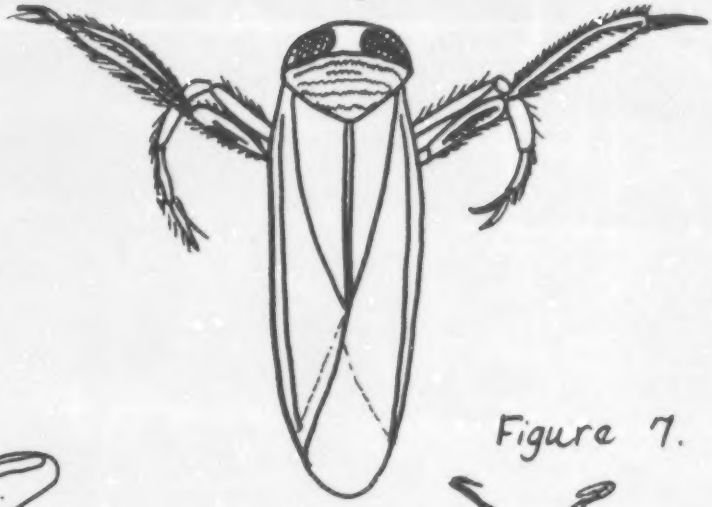


Figure 6.

Giant Water bug

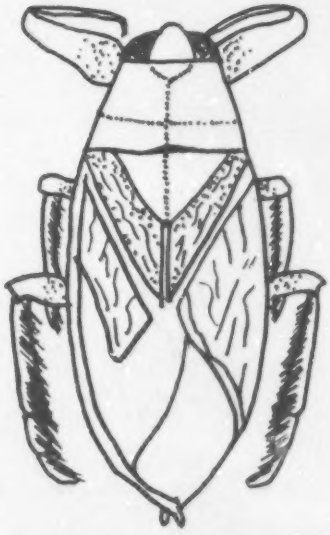


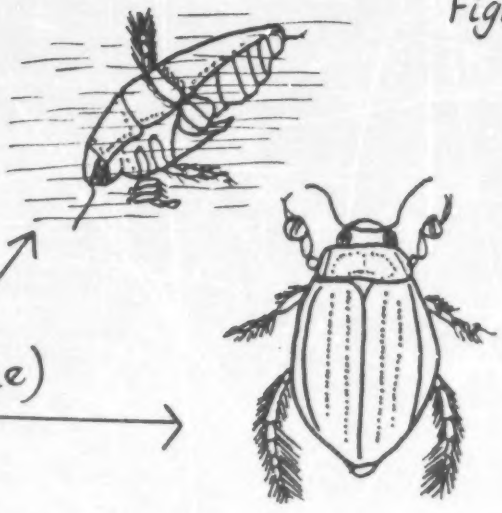
Figure 7.

Crawling Water beatles
(Halipidae)

Crawling Water Beetle
(Halipidae)

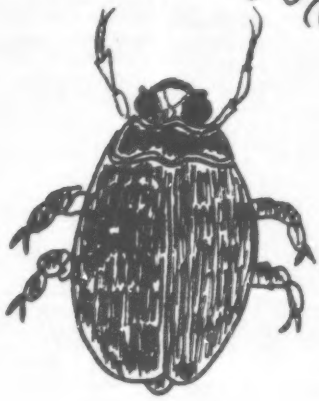
Figure 8.

Figure 9.



Predaceous Diving Beetle (Dytiscidae)

Figure 10. Whirligig Beetle (Gyrinidae)



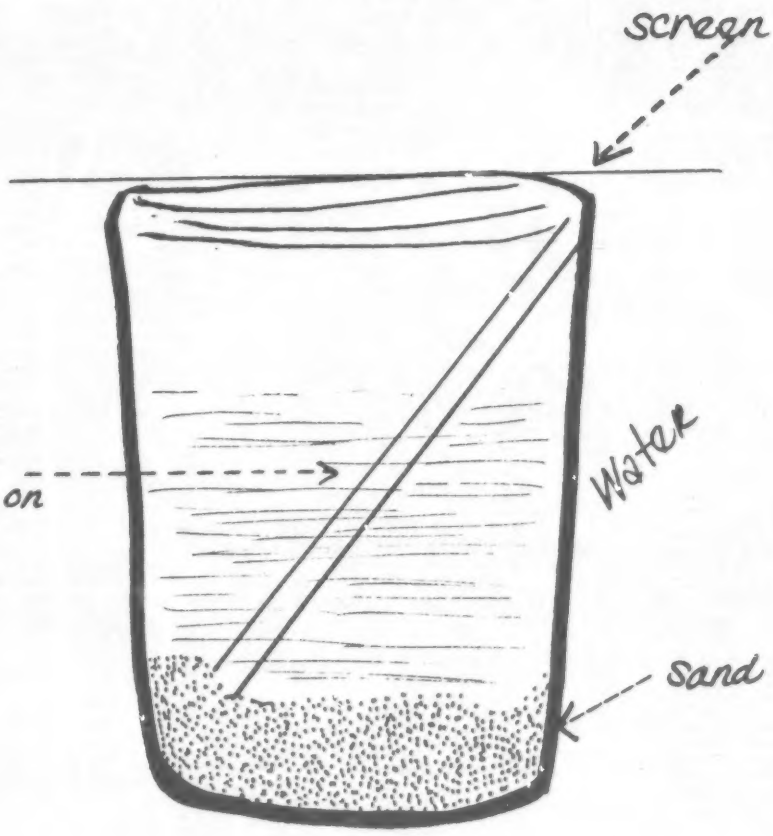
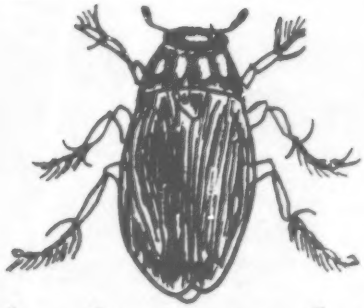


Figure 11.



Water Scavenger Beetle
(Hydrophilidae)

Figure 12. Aquatic Insect Aquarium